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ABSTRACT

Many secondary and postsecondary basic skills programs are designed to assist students whose ability to succeed in traditional subject matter instruction is in question. Research done in business, industry, and particularly in the military provides procedures that may increase the likelihood of success in such programs. Analyses of on-the-job reading and writing skills have included task analysis, the use of restricted vocabularies, readability of materials, the importance of listening or verbal ability, and the difference between reading demands on-the-job and during job training. The information gathered using these procedures is of less interest than the procedures themselves, since their use is designed to provide short term training on literacy tasks of immediate importance. The first major task in developing a literacy curriculum relevant to subject matter instruction is to identify specific literacy tasks involved in students' completion of subject matter instruction. General vocabulary and technical vocabularies for each subject should be established based on actual reading demands. The transfer of basic skills instruction to subject matter instruction will be more direct and may increase retention of the skills and retention of the high-risk student. (MKM)

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FUNCTIONAL JOB LITERACY: IMPLICATIONS FOR INSTRUCTION

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FUNCTIONAL JOB LITERACY: IMPLICATIONS FOR INSTRUCTION

Educators at both the secondary and post-secondary level are increasingly finding themselves faced with students who lack the basic reading, writing, and math skills to succeed in their subject area work. Business, industry, and the military are also faced with the problems caused by decreasing literacy skills among their employees.

One response to the problems caused by decreasing basic skills levels among secondary and post-secondary students has been to design programs to strengthen reading, writing, and math skills. The Massachusetts State College System Developmental Skills Project is one example.

In an attempt to provide instruction of general usefulness to students, the Developmental Skills Project addressed the following important question. Is it feasible to design programs to develop specific skills important not only to academic survival, but also to career success once schooling is completed? To seek an answer, we researched attempts in business, industry, and the military to define reading, writing, and math requirements of jobs. Most of the analyses located dealt with reading and writing, and the skills involved are designated functional job literacy skills.

Tom Sticht defined <u>functional</u> literacy as "possession of those literacy skills needed to perform some reading task

imposed by an external agent between the reader and a goal the reader wishes to obtain" (1975, p.12). In this context, functional job literacy involves possession of those skills necessary to reach the goal of success on the job. What are these skills, and how are they identified?

As of 1968, Sticht (1975, p.12) found no substantial research which attempted to define the boundaries of functional job literacy. However, since that time, information relevant to defining functional job literacy has become available from several sources. For the purposes of this survey, efforts to gather information are categorized as either general job analyses or designed specfically to provide information on functional job literacy.

After a review of general job analyses and functional job literacy analyses, conclusions are presented regarding the minimal likelihood of designing a successful basic skills curriculum on the basis of generic functional job literacy skills. Rather, short term support geared to immediate and specific literacy demands is described and recommended.

General Job Analyses

Can we identify functional job literacy skills from general analyses of jobs? Most job (task) analyses have not been specifically oriented toward identifying reading, writing, and math skills required for job performance. Furthermore,

general analyses have not demonstrated any degree of uniformity in technique. Some of these efforts involve defining job tasks by interviewing job incumbents and/or their supervisors. Rarely are job incumbents observed in their natural work settings to establish a list of job tasks.

In many cases, job incumbents and/or their supervisors are not interviewed to provide information for task lists. Instead, they are asked via questionnaire to react to a list of job tasks. Such a questionnaire may be based on a previously developed list of tasks as in Byers and Nowak (1972). Alternatively, questionnaires may be the second stage of a research project, having been derived from interview and/or observational procedures (see, e.g., Beavers and Smith, 1973).

Any of these procedures may produce task statements which imply functional literacy requirements. However, the utility of such information for providing detailed and complete statements of functional job literacy requirements is limited because of the methodology by which it is acquired. These procedures have doubtless proven useful for their originally intended purpose, but cannot be expected to prove equally useful outside of their original context.

General Analyses of Limited Utility

A second limitation on the utility of some job analysis information is the level of generality at which reading, writing, and math skills are stated. For example, the 1965

edition of the Dictionary of Occupational Titles lists GED ratings for each occupation. However, a GED level 4 (U.S. Dept. of Labor, 1965, p. 652) implies functional job math requirements that include at least some of the following: perform ordinary arithmetic, algebraic, and geometric procedures in standard, practical applications. In the 1977 edition, these ratings were dropped. Task element statements are now supplemented with worker functions ratings of relationships between a worker and data, people, or things. A worker function rating of 4 in relation to data specifies only that the position involves computing (U.S. Dept. of Labor, 1977, p. xviii). Such statements are assumed to be useful for the intended function of the Dictionary of Occupational Titles, but are of limited utility in providing precise and detailed statements of functional job literacy requirements.

In response to a very different need, task analysts may become involved in solving a specific problem. The resulting front end analysis is described by, for example, Harless (1975), and is practiced by some of the industrial personnel interviewed in preparing this document. A complete job description is not the intended product of front end analysis, and results are not ordinarily published. Thus, such efforts are again of value for their original purpose, but do not readily provide information on functional job literacy requirements.

General Analyses of Some Utility

Task analysts in business, industry, and the military sometimes do analyses to describe single jobs or clusters of jobs and these may provide clues to the literacy demands of the job. For example, an interview on work done at Digital Equipment Corporation emphasized the need for skills in obtaining information from tables, particularly computer produced tables. The Bell System is another company which produces detailed task lists for some jobs. Analysts in both companies, however, suggested the possibility of obtaining a hierarchy of literacy skills elsewhere and cooperating with business and industry to validate those skills as regards their necessity for job success.

One procedure would be to obtain basic skills tests, referenced to an extant hierarchy of objectives. These tests would be administered to new employees. Then relationships could be statistically analyzed between test results and subsequent job performance.

Business and industry also operate a number of basic skills training programs. However, research on these programs failed to discover any cooperation between task analysts and directors of reading, writing, and/or math programs. Despite this lack of formal information sources, program directors willingly offered suggestions as to what skills were job relevant, and they can be expected to have more direct contact

with functional job literacy demands than educators outside business and industry.

Job relevant comments from basic skills program directors most often referred to writing. Short written outputs at a functional rate with stress on clarity make sense in a business context. However, writing as well as other basic skills curricula in the businesses and industries interviewed do not appear to be, in any objective sense, based on functional job literacy skills identified through careful task analysis.

In the military, task analysis of single jobs and clusters of jobs supports training program development. The Navy's JOBS project has developed a curriculum for one job cluster based on generic skills and plans to develop curricula for three more clusters (Aiken, personal communication). The difficult task of comparing analyses across jobs to identify common skills will be simplified by another Navy project. The Naval Enlisted Professional Development Information System (NEPDIS, 1977) will provide common computerized formats which will greatly simplify comparisons of task analyses. This system has recently begun data entry and may, in the future, provide important information on functional job literacy requirements. However, results are not publicly available at this time from either the JOBS or the NEPDIS projects.

Information on job skills across clusters of occupations

is currently available from vocational/technical curriculum development projects. Ertel (1968, pp.31-33) listed survey responses on tasks performed by merchandising employees which, in some cases, define functional job literacy skills in writing and math. Farning and Boyce (1976) and Smith (1974) presented responses on the importance of communications competencies, only a subset of which involve reading, writing, and math. The DACUM task analysis process has been used to arrive at curriculum content in reading, writing, and math (Sinnett, 1974, pp. 78-91). As Sinnett (1974, p.29) points out, however, these content statements are only tenuously related to task analysis of job incumbents.

If full information were available from all of the sources listed in this section, then an attempt at synthesis might provide some useful information. However, the quality of the information is often questionable, and the task of integrating results from different studies is, at the very least, problematic. For example, the NEPDIS (1977) procedures were developed because of the necessity of increasing precision and comparability for Navy job analyses. Also, as noted below, the success in increasing functional literacy of a skills program designed on the basis of such generalized results would be in grave doubt. A more useful approach is based on efforts to be reviewed next: those aimed specifically at the study of on the job reading and writing.

Analyses of On-the-Job Reading and Writing

Business, industry, and the military have traditionally avoided functional job literacy problems by not accepting illiterates. However, as the manpower pool shrinks and these institutions become more socially responsive, the most frequent approach has become that of redesigning tasks so that fewer demands are made on basic skills. As reading and writing tasks have been analyzed in preparation for redesign, much of the information cited below regarding functional job literacy demands has been produced.

Blue-Cross/Blue-Shield of Massachusetts compared rates for grammatical errors on essays with supervisor ratings of the quality of memos. Close agreement in these two methods of rating employee writing skills lends some support to the importance of reducing grammatical errors in improving functional job writing skills.

In reading, four areas of research in functional job skills have received considerable attention. After reviewing attempts to establish a restricted vocabulary and to apply readability formulae to job reading materials, I will review two additional military projects and their implications for instruction.

Restricted Vocabularies

Attempts to establish limited vocabularies for

instructional and communication purposes are not new. Thorndike (1921) and others have used word counts to establish a list of most frequently used words. The set of texts from which the word counts are drawn obviously influences the outcome, with elementary reading texts those most often used. Harris and Jacobson (1972) provided a set of lists for recent texts from grades 1-6, including supplementary lists for content areas of English, social studies, mathematics, and science. The Kučera and Francis (1967) list is based on samples from a broad range of adult reading material. The American Heritage Intermediate Corpus (Carrol, Davies, and Richman, 1971) provides information on vocabulary demands of texts in a broad range of subject areas for grades 3-9.

Other attempts to establish limited vocabularies have not used word counts. Ogden (1932) listed 850 words proposed to be sufficient for all needs in ordinary communication. This subset of English was intended to be used as the international second language. Dale and O'Rourke (1976) tested students at several grade levels from 4-16 to establish the familiarity of 44,000 word meanings.

A more recent development is the attempt in several large companies (particularly multinationals) and the military to establish restricted vocabularies for use in the production of technical training manuals. Caterpillar Tractor's Fundamental English program is available through a licensing arrangement.

The NCR Fundamental English Dictionary (1978) provides a vocabulary designed specifically for technical writing in the technologies where National Cash Register is active. In attempting to establish one definition per word, the Dictionary groups 2200 word forms including 300 verbs into 1175 root words. This list does not contain nomenclature or glossary terms (defined as those requiring a formal technical definition).

Several other large companies have restricted vocabulary projects currently under way. Digital Equipment Corporation, Xerox, and Westinghouse Electric efforts are at least a sampling. Probably similar projects are in progress in other organizations.

Military applications are also available. The Army (1976) has prepared a lexicon as a guide to simplify readability and comprehensibility of technical manuals. The Navy is currently preparing a word list based on recruit training material, with supplemental word lists planned for four clusters of Navy job specialties (Kincaid, 1978).

The relationships among these restricted vocabularies are of interest. It may be possible to establish a core vocabulary. If a set of words is sufficiently important to a broad enough range of careers, then knowledge of that set of words is appropriately included in the objectives for instructional programs in secondary or post-secondary education. A word of caution is, however, in order.

Some basic skills programs are intended to prepare students

for a relatively specific educational experience. For example, basic skills may be designed to support success in the freshman year general curriculum. Where this is true, and especially where students are served because they are at risk without such support, program objectives should involve meeting the immediate demands placed on students. Determination of the basic skills curriculum in consideration of long term general occupational demands is probably not wise for these programs. In such cases, the research cited here provides procedures rather than results for the determination of the vocabulary component of a basic skills program. Frequency counts of texts used in the specific educational experience being supported can be obtained by application of the techniques used to derive these lists plus additional techniques discussed below.

Readability Research

A number of readability formulae have been developed both in academia and in the military. Average sentence and word lengths are frequently included in the computation of a grade level of difficulty for a text. Discussion of the results of such an effort usually involves linking formula results with some measure of reading ability for a text's intended users.

Bell Labs found an acceptable match between Flesch readability scores and Nelson-Denny test results for texts used in Bell System schools. Thornton (1977) computed readability levels for a variety of capentry textbooks and for installation instructions written for carpenters. Texts were then chosen at mean readability levels for Cloze testing of students. In a

multiple-choice variant of the Cloze procedure, most students scored at the instructional level i.e., the texts were appropriate for instruction, but not independent reading. Digital Equipment Corporation has also used multiple choice Cloze procedures to explore the match between texts and intended users.

Implications for selecting instructional content are not easily drawn from this research, partly because results are usually stated in terms of ill-defined reading grade levels. Curriculum applications have most often implemented the business and industrial tactic mentioned above. Texts are selected or rewritten to lower the demand on reading skills. In other words, the task is redesigned to lessen basic skill demands.

The success of using readability formulae in redesigning or selecting texts was not demonstrated in any of the literature reviewed or persons interviewed in preparing this report. In fact, Curran (1976) questioned the relationship of readability formulae to comprehensibility and to useability of text. He hypothesized that readability is a necessary but not sufficient condition for comprehensibility, and that both are necessary but not sufficient for useability (Curran, 1976, p. 170). However, an operational definition of useability was not provided, nor was research establishing these relationships cited. In addition, Curran (1976, pp. 183-184) questioned

the relationship of Cloze testing to readability and accepted it as an operational definition of comprehensibility after questioning the relationship of Cloze to other measures of comprehensibility.

A word of caution seems appropirate to end consideration of readability research before examining other military reading research. The method of measurement selected may determine the conclusions reached. Sticht (1976, p. 26) stated that reading demands are not discovered; they are created by the procedure used.

Listening versus Reading

"It is clear that if a person does not know the meaning of a word, then instructional practice must differ from what we would do if the person knew the meaning of a word when that word was spoken but could not recognize the word when presented in the printed form" (Sticht, 1976, p. 34). The truth of this statement is not likely to be contested. Ernst Rothkopf (personal communication) noted that if language problems are present in speaking and listening as well as writing and reading, then the remedy is to change the way people think, not teach decoding skills.

If different instruction is to be provided for people who have listening but not reading skills, then diagnostic instruments are needed which are valid and efficient to administer. The Air Force Literacy Assessment Battery (Sticht and

Beck, 1976) attempts to fill this need and has received the 1978 Harris award of the International Reading Association.

Army JRTT Research

For many occupations, it is useful to distinguish functional job literacy demands during training from demands made on the job once initial training is completed. Training demands are usually greater and often involve reading in order to form and retain new concepts, as opposed to reading on the job to look up specific information for relatively immediate use. In addition, Sticht, Fox, Hauke, and Zapf (1976) found that 62% of reading tasks by Navy personnel on the job involve just figures or figures and text as opposed to straight prose reading.

HUMRRO completed research for the Army which examined on-the-job reading in considerable detail for three military occupational specialties. Reading tasks were categorized as: 1) inherently involving reading, (e.g., responding to correspondence) or 2) possibly requiring reference to instructions for success (e.g., changing a tire). Caylor, Sticht, Fox, and Ford (1973) caution, however, against accepting supervisors' descriptions of official job reading demands. Extensive reading material may be listed which is available but is never or rarely used by job incumbents.

To obtain accurate records of materials actually read on the job, Caylor et al. (1973) interviewed job incumbents at job

sites. Furthermore, each interviewee was asked to produce the material read and to indicate the specific passage read and the information sought. Passages were then categorized.

The specific information obtained is not as directly useful as the procedures used. The "job" of getting through college is more like job training than on-the-job experiences.

A Suggested Approach to Functional Literacy Instruction

Many secondary and post-secondary basic skills programs are designed to assist students whose ability to fully succeed in traditional subject matter instruction is in question. Research done in business, industry, and particularly in the military provides procedures which will increase the likelihood of success in such programs. Information gathered using these procedures is of less interest than the procedures themselves, since their use is designed to provide short term training on literacy tasks of immediate importance.

The first major task in developing a literacy curriculum relevant to subject matter instruction is to identify specific literacy tasks involved in student completion of subject matter instruction. Interviews are needed with students at sites where they complete assignments, attend lectures, etc. It would be unwise, for example, to simply assume that it is necessary to read the course text in order to succeed. Likewise, math skills necessary for completion of officially

suggested homework in the physical sciences may or may not be used by successful students. Interviews should also take place throughout the time students are engaged in whichever subject matter courses are being supported. First priority should go to those subject matter courses enrolling the largest number of at risk students. In interviews, the students should be asked to produce the materials involved and to explain what they did with them.

As a sufficient body of information is gathered, materials can be grouped according to the basic skills used. Instruction can then be based on those tasks and materials involved in successful subject matter classroom performance. Also, a task should be studied at the time that task is required in subject matter courses. Some students will require instruction in skills prerequisite to those directly relevant to subject matter classroom performance. In such cases, additional instruction should be as brief as possible.

From reading materials gathered during interviews, it will also be possible to establish both a general vocabulary and technical vocabularies for each subject matter area supported. These vocabularies will then be based on actual reading demands. If these words are not a part of a student's reading vocabulary, then the instructional approach used with that student should be based on a diagnosis of the student deficit as based on a discrepancy between listening and reading skills, or on a lack of language development.

Questions will doubtless be raised as to the generality of basic skills resulting from such a program. These questions can only be answered by implementation of the approach. However, the transfer of basic skills instruction to subject matter instruction will certainly be more direct. The more immediate reinforcement available from relevant use of the skills should not only increase retention of the skills but also the retention of at-risk students in the institution. There is little likelihood that instruction in a remote, career-related, generic literacy skill will be retained without more immediate use.

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